

Client: W2T

Title: 2Degrees

Date: 19 September 2012



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How do you really optimize energy output from waste

17 hours ago | Blog post written by *Director* from the *Sustainability* industry

There has been a drive to find a technology that will efficiently extract energy from waste. As the market has developed, there has certainly been a lot of government interest in promoting advanced conversion technologies. The UK government has been focused on Advanced Conversion Technology, such as pyrolysis, gasification and anaerobic digestion.

Waste2Tricity - my company - has focused on gasification.

Current techniques of high temperature air enriched thermal processes need around 20-30,000 tonnes of municipal solid waste (MSW) every year for each 1MW of electrical generating capacity. However, Waste2Tricity (W2T) believes its well on its way to generating the same amount of power from as little as 7-10,000 tonnes.



Waste to energy: An ongoing challenge

In 2009, W2T was established as a 'structured solutions provider' to the energy-from-waste (EfW) sector. It is a company that intends to take carbon-based waste – either MSW or waste from business and industry – and convert it into clean electricity, creating the potential for a new technology to change the face of the EfW industry.

The company's business plan is based on a simple premise – to apply the most efficient and economic technologies to achieve the effective conversion of scrap carbon to energy.

In our process we will convert our waste into a syngas in an air starved chamber which is then either fed into an internal combustion engine (ICE) or converted to hydrogen for a fuel cell, to produce electricity. By forming consortia, identifying exit markets and reducing carbon footprints we will increase the rate of energy conversion and enable the sale of the end product for a higher value per gigajoule of energy.

As the UK consents more waste facilities there will be a potential surplus of capacity compared to the tonnage in the waste stream. So determining the right technological solution will revolve around three key critical elements: generating maximum energetic conversion efficiency from the waste; selling that energy at a higher price than anyone else, and doing so with the lowest carbon footprint in the process (thus obviating future threats from carbon tax exposure).

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Meeting those three criteria more successfully than others will produce strong competitive advantage in reducing feedstock gate fees to maintain operational effectiveness. W2T works with partners and clients who want to utilise proven plasma-gasification technology at the front-end and proven ICEs or gas turbines (GTs) at the back-end of their operations.

In this process, waste enters a plasma gasification chamber and is turned into syngas by the application of very high temperatures in a controlled oxygen environment. The syngas is cleaned and fed into an ICE or GT to generate electrical power and finally it goes through a transformer before distribution. At both front and back ends this configuration has significant advantages over the prevailing thermal EfW industry standard – mass burn technology.

Exclusive rights

W2T has also secured exclusive UK rights for waste-derived hydrogen applications for AFC Energy's low cost alkaline fuel cells, having identified this technology as offering the highest possible conversion rate of hydrogen to electricity at the lowest possible cost.

In terms of this process, the syngas from the gasifier will be cleaned, processed and then all of the energy gas's will be converted into hydrogen, leaving all the CO₂ in a captured state. The hydrogen will then be fed into new generation AFC Energy alkaline fuel cells, in place of ICEs or GT's.

This will result in a substantial increase in the gross generated electricity from the same feedstock input, in the region of 50% additional power output. In the case of the Teesside project deploying fuel cells would increase total output over the projected combined cycle power island from 49 to over 70MW and in the W2T project 80,000 tons of MSW/C+I waste would produce approx 17MW.

As a 'structured solutions provider' to the energy from waste sector, W2T has dual commitments to deliver technology that is future-proofed and to develop programmes that will be proven, profitable and progressive.

We are currently involved in two main deployment projects and a development programme which we believe will define the EfW market for the foreseeable future.

The technology in action

The first deployment project for the fuel cells is being investigated with global gas supplier, Air Products. Air Products has secured planning consent to develop a 49MW (330,000 tonne) gasification EfW facility, deploying gas turbines, near Billingham, Teesside; and this project will in addition demonstrate fuel cells on hydrogen slipstreamed from the syngas stream. W2T identified the Teesside site for Air Products and this facility will produce around 49MW of electricity, enough to power 50,000 homes in the region - but it is not just homes that this type of systems could benefit.

The benefits of future projects are about delivering energy security for big employers at locations such as docks, industrial estates, warehouses and hospitals, places with half hourly interruptible power supplies. The aim is to deliver these waste technology plants into a framework to underpin supply to their local employers via private wires. It's not just about waste any more, it's about industry's energy supply and reducing carbon footprint at a time when energy prices are rising.

It's the energy load at the point of demand that will drive the technology, so you won't employ anaerobic digestion if you need combined heat and power; and you wouldn't necessarily put a gasifier in if you were right next to a plastics recycling plant. The right technology depends on where, and what, the demand for substitution of fossil energy is.

For every tonne of waste these new technologies can make more money and so allow the operators to outbid others when more waste feedstock becomes available, which is vital as we move away from being an industry that simply *solves the problem* of waste and makes money from gate fees, to one that makes money from back-end processes; converting our feedstock – waste – into products, selling gas, electricity, recycle or whatever.

With carbon taxation on its way, making a profit from a process with a lower carbon footprint will be vital.

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The second deployment project is part of a consortium to develop smaller scale (circa 12MW/80,000 tonne) plasma gasification EFW facilities deploying ICEs. The development of smaller scale facilities affords a growth opportunity in a market that the proposed Air Products' Teesside investment makes a commercially viable and investable reality. W2T is developing relationships with key partners that will help it identify sites and we see other large players – resource management companies with large balance sheets, land owners and civil engineers – entering the market and forming consortiums.

As the founding consortium member, W2T is currently spearheading talks with industry specialists about a proposal to structure the investment opportunity and co-ordinate the consortium's activities. The project lifecycle is projected to be about five years and preliminary studies indicate costs in the region of £60 million.

So, with end markets identified, partners to help with finding locations already in place and the Tees Valley Renewable Energy Facility set to showcase the technologies, are we set to see the "revolution" any time soon?

The fuel cell technology is developmental, although the ICE system is established now, but it will take three or four years to percolate through the industry. There has been plenty of revolution, but we acknowledge there is no *one* solution, no silver bullet. Finance is also an issue as there is a hiatus on investment at present and those that are looking to invest are technology-centric. There is also some suspicion over new technologies.

To maximise the investment case, at W2T we identify the exit markets for the product and work backwards, looking at supplying renewable energy in situ. Because putting the energy into the Grid is a large component of the supply chain cost, smaller scale local distribution solutions are where the "revolution" looks set to start.

Peter Jones is non-executive chairman of Waste2tricity